EÖTVÖS LORÁND UNIVERSITY

DEPARTMENT OF CARTOGRAPHY AND GEOINFORMATICS

The role of Geoinformatics in the Hungarian primary and secondary education

Krisztina Dékány

Ph. D theses

Doctoral School of Earth Sciences

Program leader: Judit Bartholy DSc

Cartography and Geoinformatics Doctoral Program

Program coordinator: Prof. László Zentai

Supervisor: José Jesús Reyes Nunez, PhD

ELTE Department of Cartography and Geoinformatics

Budapest

2019

I. BACKGROUND AND OBJECTIVES OF THE RESEARCH

I have always been interested in geoinformatics, that is the reason why I studied and graduated in GIS from Neumann János Vocational School of Informatics. Although I have got a degree as geography-mathematics teacher, I turned on examine geoinformatics again, but now I was starting to examine the educational aspects from a research teacher's point of view.

My primary goal was to establish a link between geoinformatics used in Hungary mainly in the public and corporate sectors and its applicability in public education (where possible) and to make authentic suggestions on how to use GIS in teaching.

During my PhD, I had the opportunity to study a semester in Spain, where I gained an insight into the Basque education system. Based on that experiences, I have fixed the theoretical and practical aims of my research. At that time, I decided to test the results of my theoretical research in practice by developing a website that could help the application of geoinformatics in Hungarian schools.

In the meantime, the Hungarian public education system has changed, which on the one hand gives teachers more opportunities to establish and apply new information and communication technologies into their lessons, but on the other hand, significantly expanding the curriculum and reducing teaching time, which makes it difficult to try new methods and initiate them into everyday teaching practice according to the opinions of the teachers complaining about the constant lack of time. Therefore, my goal was to formulate a curriculum that includes not only basic theoretical knowledge, but also practical exercises that require relatively less time for preparation, which are modern and motivating for all participants. I hope that this can be the beginning of the application of geoinformatics as a part of a lesson, and later it can lead to more time using GIS for such lessons.

II. APPLIED METHODS

The type of my research is applied, because its theoretical results are used within a very specific area: completing the teaching of geography with geoinformatics tools in secondary education, and how they can be used in other subjects. The research process should be divided into two main phases: the first phase is theoretical, and the results achieved here will provide the basis for the successful completion of the tasks planned for the second (pragmatic) phase.

Theoretical research

Since didactics is a constantly growing scientific field, I initially studied the major trends that have a great impact on current teaching processes. I continued my research by reviewing international literature. The number of studies and research developed in Hungary in this specific topic is irrelevant. For this reason, in the initial phase of my research, I focused primarily on studies on the relationship between geoinformatics and public education published abroad, for example in the United States and in various European countries. In addition to theoretical topics, I also read about at what level and age of the students they use geoinformatics in schools, and what are the experiences of the teachers.

During my theoretical research I used mainly analytical and comparative methods. I had to examine and analyze the research descriptions and results in the professional literature in the spirit of my goals, to select and compare the items for my own use and to draw my own conclusions based on them. Only then I determined what geoinformatics knowledge could be included in the geoinformatics course to be implemented in the practical phase.

Practical research

During my Ph.D. studies, I was a full-time teacher at the II. Rákóczi Ferenc High School in Budapest, where I was given the opportunity to explore the feasibility of using geoinformatics in teaching and learning, both in class and in a study group.

This research stage can also be divided into two main parts: the first is to determine the structure and content of the geoinformatics course based on the results of the theoretical research. The second part contains two main tasks, which I was able to test in practice: to organize and implement a geoinformatics course and to create a website to be used in the course.

The web page engine is free, easy to modify and offers many more features. This site contains all the tutorials we have already used, from the basics of mapping to the basic operations that can be used in various geoinformatics programs, as well as the further readings in this subject. In the meantime, as the website engine was terminated, I had to look for another one, but I managed to transfer all the curriculum content to the new website, so they are still available.

III. RESEARCH RESULTS (THESES)

1. Taking into consideration the professional and methodical aspects, I examined the Hungarian public education system regarding the introduction of geoinformatics

The current legislations and regulations support innovative teaching methods, such as geoinformatics, that can be manage as cross-curricular projects, and are capable of developing different competences according to the Hungarian National Curriculum. I noticed that, under the current regulations, geoinformatics could be introduced into education in a study group or in single lessons as well, and later on it could be implemented in the form of so-called 'Good Practice'.

2. I made a survey for teachers and students in the field of cartography and geoinformatics and analyzed the results, afterwards I drew professional-scientific conclusions on the role of geoinformatics in public education

Based on the responses of 40 educators and 217 students, it can be confirmed that currently neither the available IT tools nor the availability of interactive maps are well utilized in public education. After analyzing the results, I found that further cartographic concepts and functions need to be taught. Based on all these, I can state that the theoretical and practical knowledge of geoinformatics should be incorporated into the teaching process, utilized in the educational activity, but this would require prior training for teachers and, of course, the development of appropriate tools as well.

3. I have studied the scientific results in the international professional literature and based on this I have analyzed, structured and summarized the knowledge to be taught worldwide, and regarding this I created my own suggestions

The literature available in English language contains rich documentation on the basis of which I started my research, so I was able to analyze and use more than twenty different sources for their adaptation in Hungary. Most of them contain actual suggestions, but it has to be stated that in Hungary, a large part of them cannot be easily integrated into public education. Almost all foreign case studies begin with the introduction of cartography, as this knowledge is a basic requirement for teaching geoinformatics. The other modules then follow each other similarly: projections, map types, satellite imagery, vector models, map layers, and so on.

4. I analyzed curricula developed by international professional organizations and associations to facilitate the introduction of geoinformatics and adapted the results into my research

Numerous research groups are working on the integration of certain elements of geoinformatics into the educational process. Many of them offer in-service training for educators, as well accept applications for various GIS projects. While revising these websites, I found several curriculum ideas and educational materials, which could be used as a theoretical basis in Hungary (also considering the special characteristics of the Hungarian education). With the help of these, I have created a collection of Internet-based applications that can be used by teachers in any subject, and they can use the elements of geoinformatics in the teaching process.

5. I studied the basis of teaching geoinformatics in Hungarian secondary education: I determined the needed essential knowledge taking into account the factors influencing Hungarian public education as well as the structure and the content of a GIS course

After a joint analysis of international experiences and professional literature, I have defined the basics of geoinformatics that need to be taught in a study group in order to students can have opportunities to use most of the mapping and analysis capabilities of geoinformatics.

I formulated a curriculum in which I divided the knowledge determined during the theoretical research into three parts: introduction to cartography, basics of geoinformatics, and getting to know some GIS programs. Each section constitutes an educational module and each module consists of four topics (on average). After each module, I planned a study visit to an external location (for example, HM Zrínyi Mapping and Communication Services Nonprofit Ltd.) and drafted two projects during the school year.

6. The determination and development of the essential knowledge for teaching geoinformatics, and its practical test

During my theoretical research, I first studied the subject-related knowledge and collected experience gained in other countries, examined it and adapted it to the specific conditions in Hungary. I have stated that geoinformatics education should begin with the basics of cartography, as this knowledge is a basic requirement for the correct presentation of data analysis with geoinformatics.

I felt it necessary to test in practice the results achieved in the theoretical phase. For this reason, after designing and developing the syllabus and the curriculum for the geoinformatics study group, I also created an educational website and, in the meantime, I have organized and realized a study group in practice. After finishing the course, I found that teaching geoinformatics (GIS) can be integrated into the Hungarian education system.

Like all pedagogical programs, I had to arrange all of the criteria for the study group. These included identifying participants and their prior knowledge (mostly only English language and basic IT skills were needed), computers with Internet access, free versions of some GIS programs, and course materials, which I edited from freely available sources with references.

IV. CONCLUSIONS

Based on my experience, the biggest obstacle for teachers today is that, it is difficult and time-consuming to learn a new didactic method due to the lack of proper basis or minimal practice, thus it is problematic to begin teaching with geoinformatics. To facilitate this, practices which have been repeatedly tested at international level, and their translation and adaptation could be tried out in Hungary: basic GIS knowledge could be taught with proper materials (for example GIS textbooks and workbooks written by Hungarian authors or translated to Hungarian language), and further training for teachers is needed. This requires two factors: the enthusiasm and curiosity of the teaching community for this topic and the support of the authorities responsible for education.

V. LIST OF REFERENCES (EXTRACT FROM THE PRINTED REFERENCES AND INTERNET LINKS)

Green, D. R. (2001): GIS in schools education: you don't neccesarily need a microcomputer. In *GIS: A sourcebook for schools*, Taylor & Francis, London and New York, pp. 45.

Dr. Makádi M. szerk. (2015): Tevékenykedtető módszerek a földrajztanításban, Eötvös Loránd Tudományegyetem Természettudományi Kar, Budapest

Rød, J. K., Larsen, W., & Nilsen, E. (2010). Learning geography with GIS: Integrating GIS into undergraduate geography curricula. Norwegian Journal of Geography, 64(1), pp. 21–34.

110/2012. (VI. 4.) Korm. rendelet a Nemzeti alaptanterv kiadásáról, bevezetéséről és alkalmazásáról, https://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=a1200110.kor

GIS Best Practices, Higher Education, ESRI, 2011, https://www.esri.com/library/bestpractices/higher-education.pdf

Integrating GIS Use in Education in Several Subjects (iGuess), http://www.iguess.eu

Teach with GIS, An Implementation Guide For Teachers, Schools, and Districts, http://learn.arcgis.com/en/educators/

VI. LIST OF PUBLICATIONS IN THE SUBJECT OF THE DISSERTATION

Dékány K. (2016): Térképet mindenhova!: Geoinformatika kezdőknek és haladóknak, In: Új Köznevelés 72. (4) pp. 12–15.

Dékány K. (2016): Geoinformatika az oktatásban: egy szakkör tapasztalatai, In: Pajtókné T. I. – Tóth A. (Szerk): Magyar Földrajzi Napok 2016, konferenciakötet: VIII. Magyar Földrajzi Konferencia, XVI. Geográfus Doktoranduszok Országos Konferenciája, Oktatás-módszertani és Földrajztanári Konferencia; Agria Geográfia Alapítvány, pp. 920–926.

Dékány K. (2018): Geoinformatika a közoktatásban – Avagy hogyan tudnánk felhasználni a nemzetközi tapasztalatokat hazánkban?, GeoMetodika Tanulmányok, http://foldrajztanitas.elte.hu/index.php/2018/10/11/geoinformatika-a-kozoktatasban-avagy-hogyan-tudnank-felhasznalni-a-nemzetkozi-tapasztalatokat-hazankban/

Dékány K. (2019): Geoinformatika a közoktatásban – Nemzetközi iskolai hálózatok, In: GeoMetodika, 3. évf. 1. szám, pp. 59–68.

Dékány K. (2019): GIS in Secondary Education in Hungary – Experiences in Lessons and in a Study Group, In: Miguel Gonzalez, R. – Donert. K. – Koutsopoulos, K. (Eds.): Geospatial Technologies in Geography Education, Key Challenges in Geography Series, Springer, pp. 201–219.